the cause of cancer we are dealing with two factors—(1) a predisposing cause, probably due to auxetics, which are set free by injury, X-rays, and atrophy, which are actually injected into the tissues by the commodities, and which occur in excess in the tissues generally in persons above the age of forty—the cancer age; and (2) an exciting cause, the nature of which has still to be worked out, and which supervenes on top of (1). Whatever this exciting cause is, it is responsible for the metastasis and death. It would seem that a combination of the two causes is essential, namely, that cancer is due to local manuring of the tissue; either one or other by itself appears only to cause benign tumour formation. H. C. ROSS.

The John Howard McFadden Research Fund,
The Lister Institute of Preventive Medicine,
Chelsea Gardens, S.W.

DR. ROSS'S letter raises the question as to whether photosensitive molecular systems of the nature of those contained in the gelatino-bromide emulsion might not be affected by auxetics and augmentors applied under suitable conditions. If such effect was found to exist, the facts he adduces would not be out of line with the view that some molecular change within the cell finds a counterpart in actions progressing in the unstable film under the stimulus of radiation or equivalent chemical influences.

The reasons set forth by Dr. Ross against the theory that soot acts mechanically appear convincing, although I cannot agree with him that this substance can be described as soft and floury. There has always been difficulty in accounting for its peculiar virulence on the mechanical theory. Some time ago I looked for the emanation of radium in soot, but found very little. If it acted like charcoal we would expect a large amount, in which case Dr. Lazarus-Barlow's views would find additional support in this direction.

I may add that some of the suggestions put forward in the lecture which was in part issued in NATURE of June 10 have been under investigation here for some time. J. JOLY.

Trinity College, Dublin.

The Magnetic Storm of June 17 and Solar Disturbances.

As my final note on Dr. Chree's letter in NATURE of July 22 and Mr. Buss's of July 29 may I remark that, so far as I am aware, there is no rule, "One spot, one storm"? On the contrary, a disturbed area of the sun's surface may be connected with a series of successive, or intermittent disturbances, as it is carried round by the sun's rotation. When the same region reappears at the next synodical rotation, and sometimes, if it survives as an active region, for several synodical rotations, it will continue to be associated with a series of magnetic disturbances at each rotation. For instance, in 1898, January 11 to July 31, a disturbed region of the sun, which subsisted during eight rotations, was associated with not one only, but with several magnetic storms, at each successive reappearance. Nor is the selection of such a region arbitrary, when there happen to be several other disturbances at the same time on the sun. The selection is conditioned by the activity of the region, and by its position relatively to the position of the earth, when projected on the sun. So far as I am aware, mere statistical enumerations of sun-spots, or total areas of sun-spots, and their relations to magnetic storms, take no account of these important considerations.

The efficiency of a disturbed region of the sun, marked by sun-spots, is greater on the descending portion of the sun-spot curve than even at maximum. The reason of this is, because after the maximum, the mean latitude of the spots is falling towards the sun's equator, and since the heliographic latitude of the earth varies between $\pm 7^\circ$, the earth is placed in a more favourable position to be affected by a solar disturbance. In the twenty-five years, 1889–1913, there were seven years in which the mean daily projected or disc-area of sun-spots was greater than 1000 10^{-6} units, and eighteen years in which it was less. In the seven maximum years there was a mean of 100 disturbances a year, and a yearly mean daily disc-area of 1537·7 units. The ratio between these two numbers, or what may be termed the "efficiency ratio," is 0·065. Similarly for the eighteen years in which the mean daily disc-area was less than 1000 10^{-6} units, the mean number of disturbances was 73·7 per year, and the yearly mean daily disc-area was 378·9 units, which gives an "efficiency ratio" 0·195, three times as great as in the maximum years. Of these eighteen years, twelve were on the descending arm of the sun-spot curve. These numbers show that the position of a disturbed region of the sun relatively to the earth is more important than its size. In addition, the character of the spot has to be considered.

To apply these principles of selection to the case of the magnetic storm of June 17. Since the beginning of 1913, all the sun-spot disturbances, with insignificant exceptions, had been confined to regions above 12° on each side of the solar equator. From June 12 to June 21 an entirely new active group of spots covering a considerable area appeared on the sun's equator. The heliographic latitude of the earth was also most favourable. The first very great magnetic storm of the present solar cycle took place on June 17, preceded by a disturbance on the 16th, and followed by a disturbance on the 18th.

With regard to the 27-day period shown in the quiet magnetic days, I associated them with the whole solar hemisphere only in this sense, that, as a rule, when there is no solar spot, there is no magnetic disturbance. The proviso is added, because a region of the sun which may be free from spots may, by the presence of faculæ or flocculi, still continue to be magnetically active, after the spots have died away. In several cases the region will continue to be magnetically active, on account of the appearance of new spots near the faculæ or flocculi belonging to the former disturbance. A. L. CORTIE.

Stonyhurst College Observatory, Blackburn,
Lancs., July 23.

Science and Food-Supply.

IN connection with the proposed "Mobilisation of Science," it may be of importance for Great Britain to direct the attention of her scientific men to the possibility of increasing the food-supply produced in the country. Here she might very hopefully call upon her organic chemists for aid; by asking them to devise means for extracting nutritive material from the crops which are not now used for food.

Nearly all vegetable matter contains the nutritive elements needed. In a certain sense, for example, "all flesh is grass"; but we cannot digest vegetable matter of that kind directly; it must be put through a chemical process before it can be assimilated. The process usually adopted is to put it into the stomachs of animals, and then we eat the animals. Through the intervention of cattle and sheep we thus eat grass in the form of beef and mutton.

In a similar manner, deer and goats and many other animals which are not limited to a grass diet convert moss, and shrubs, and bark, and small branches into nutritive material for man. The wood

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of trees, too, contains the necessary elements for the support of life; but we do not utilise wood for food, because we have no animals that feed upon wood. Could not chemists do something with wood-pulp in this connection?

The German chemists are reported in the American newspapers to have succeeded in treating sawdust so as to extract a nutritive product that can be digested by man, the so-called "bread from sawdust."[1] If this is true, the British chemists should certainly be able to arrive at a similar result.

How secure Great Britain would be if she, too, could make bread from sawdust, and convert grass and shrubs and other vegetable matter not now utilised into food for her people. Here is a problem of the greatest consequence to Great Britain that should be brought to the attention of her scientific men.

ALEXANDER GRAHAM BELL.

Beinn Bhreagh, near Baddeck, Nova Scotia,
July 10.

THE PROMOTION OF RESEARCH BY THE STATE.

THE Government scheme for the organisation and development of scientific and industrial research, of which we gave particulars last week, represents a welcome concession of a principle always advocated in these columns, and stated with particular force by Sir Norman Lockyer in his presidential address on "The Influence of Brain-power on History," delivered at the Southport meeting of the British Association in 1903. The duty of a State to organise its forces as carefully for peace as for war was emphasised on that occasion; and it was urged that adequate provision for scientific education and research is an essential part of a modern State's machinery, and should be efficiently organised if we were not to fall behind other nations in the applications of science to industry. The recognition of the State's responsibility in this matter would have come much sooner if our statesmen had been wise enough to understand the scientific factors of industrial success; but it has at last been given, and the unanimous approval with which the scheme has been received must be a little surprising to the politicians who have taken so long to realise the part science is playing in the modern world, and to make provision for its national use.

There is nothing, perhaps, so difficult as to alter a long-established tradition, to effect a real change in the mental attitude of a person or of a nation. It is the greatest of revolutions; it is the real revolution on which all action out of harmony with the tradition of the past depends. Such a change of attitude, so far as the official mind of the country is concerned, was announced last May by Mr. Pease, then President of the Board of Education, when he stated in the House of Commons:

> The war has brought home to us . . . that we have been far too dependent . . . upon the foreigner, and we have realised that it is essential, if we are going to maintain our position in the world, to make better use of our scientifically trained workers, that we must increase the number of those workers, and that we must endeavour to secure that industry is closely associated with our scientific workers, and promote a proper system of encouragement of research workers, especially in our universities.

These convictions have been translated into deeds through the issue of the Government scheme. The action which has thus been taken by the Government will be hailed by all men of science with feelings of the utmost gratification. It is difficult to overestimate the value of the consequences which may follow—which, indeed, we feel sure will follow—from the adoption of this scheme. By its inception and publication the Government acknowledges and proclaims its appreciation of the work of science, and by this acknowledgment alone it gives scientific workers that encouragement and prestige in the eyes of the country which have too long been withheld.

The expenditure of any new moneys provided by Parliament for scientific and industrial research will be under the control of a committee of the Privy Council, upon the recommendation of the Advisory Council. The appointment of Lord Haldane as a non-official member of the committee of the Privy Council connects the British Science Guild with the work contemplated by the Government scheme. Lord Haldane was the first president of the guild; and at the inaugural meeting in 1905 he said:—

> I believe that things will not be right until we have a scientific corps under a permanent committee, just as the Defence Committee is under the Prime Minister to-day. I mean a body that will not consist mainly of officials of the ordinary kind, but of the most eminent men of science, who will be put on the footing upon which they deserve to be placed, and are recognised as a body of men who will be at the elbow of the department and can organise the scientific work of the State. I hope that if we get to this position the example of a Government adopting science will be followed by the municipalities, as I believe it is going to be followed more and more by our manufacturers.

The British Science Guild may justly claim some credit for securing the State assistance for industrial and scientific research now provided for by the Government scheme. For the ten years of its existence it has persistently pointed out that our competitors have brought all the products of science into the contest they have waged against us; and it has urged the adoption of similar methods in our national affairs and manufactures. Scientific men are so closely concerned with their own particular researches that they frequently take little interest in the work of others or in the position which science should occupy in national polity. Their inactivity in this respect is largely responsible for the neglect of science. A public movement was required to direct the attention of the public in general, and the Government and political parties in particular, to the value of the great resources of science in the development of the kingdom; and this movement took shape in the British Science Guild. The purpose of the guild is not so much the acquisi-

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[1] For other references to what the German chemists are doing, see article on "Inorganic Fodder" in the *Scientific American* for July 3, p. 8; in which reference is also made to an attempt to derive from straw and hay all the nourishing matter contained therein.

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